APPENDIX 21

Fluid Mineral Reasonably Foreseeable Development

I. Introduction

The baseline Reasonably Foreseeable Development Scenario (RFD) presented here is based on a continuation of current management (no action alternative) as directed by BLM Handbook H-1624-1. The RFD projects the number of wells expected to be drilled in the planning area during the next 20 years on all lands (BLM, USFS, State of Utah and private). Reasonable assumptions, based on past and present activity, of surface disturbance for each well will be used to determine impacts from oil and gas activity for the no action alternative.

II. Past and Present Activity

The Price Field Office has a long history of oil and gas activity but interest has greatly accelerated during the past 15 years with the discovery of a large coalbed methane (CBM) resource in the Ferron Sandstone Member of the Mancos Shale. This interest in CBM also extended to other coal-bearing formations especially the Blackhawk Formation and the Emery Sandstone Member of the Mancos Shale. The geology of the planning area is described in the Mineral Potential Report (Booz, Allen, Hamilton, Inc., 2002). More recently, interest in the continuous and transitional gas resource in the Wasatch and Mesaverde formations as well as gas in some deeper formations has increased in the northeastern part of the planning area.

Details of past activity, listings of conventional oil and gas fields and cumulative production and statistics for recent drilling activity are included in section 3.2 of the Mineral Potential Report. Maps 16 and 21 of the Mineral Potential Report show the locations of existing CBM and conventional oil and gas fields respectively.

Numerous older seismic surveys have been conducted in the planning area. These have been concentrated along Highway 10 in Castle Valley, the Book Cliffs area around and east of Price and along Highway 6. Map 5 in the Mineral Potential Report shows the location of Federal oil and gas leases. Most of the leases are in the northern and western parts of the area. State of Utah oil and gas leases cover large blocks of State lands south of Price. Most of the central and eastern parts of the area are currently unleased. Special Tar Sand Areas cover large areas in the northern part of the planning area and in the central part of the San Rafael Swell and have had a negative impact on leasing because of the higher minimum bid and diligence requirements imposed by the Combined Hydrocarbon Leasing Act of 1981.

More than 1,400 wells have been drilled in the Price Field office. Table 1 shows the current status of wells in the Price Field Office. Most of the recent wells were drilled to produce coalbed methane (CBM) from the coals in the Ferron Sandstone member of the Mancos Shale in the Helper, Drunkards Wash, Huntington and Buzzard Bench areas. The Castlegate Field in the northern part of the area has produced CBM from coals in the

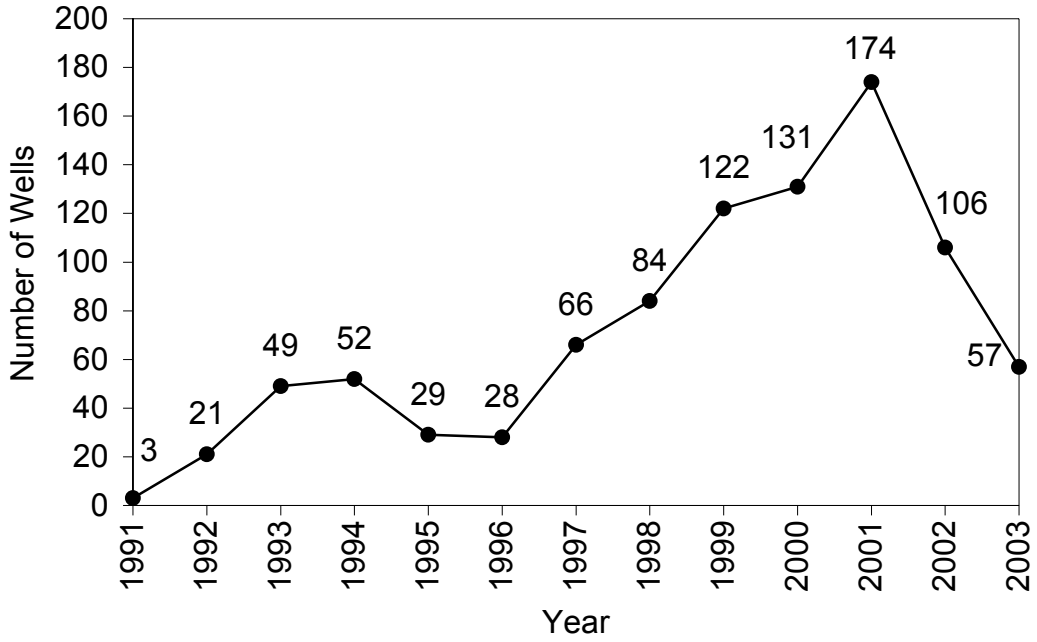
Blackhawk Formation. Drilling peaked in 2000 when 177 wells were spudded (Figure 1). The number dropped to 57 in 2003. During the period 2000-2003 only 3.2 percent of the wells drilled were dry (Utah Division of Oil, Gas and Mining). During this time period, almost all reported production was gas. As these statistics indicate, most of the wells are development CBM wells in the fields listed above and the decline in drilling in the past four years is a result of the maturing of the CBM fields. Interest in gas resources in the Wasatch, Mesaverde and deeper formations has increased recently in the northeast corner of the planning area. Bill Barrett Corp., as the operator of three units here, received 10 state permits and 3 Federal permits for Mesaverde tests in this area in 2002-2003 (Utah Division of Oil, Gas and Mining).

Table 1. Summary of Present Well Status.

Well Status	**Number of Wells**
Drilling	3
Producing Oil Wells	8
Producing Gas Wells	809
Shut in Oil Wells	13
Shut in Gas Wells	67
Service Wells (injection, disposal, monitor)	30
Shut in Service Wells	1
Temporarily Abandoned	12
Abandoned	19
Plugged and Abandoned	440
Total	**1,402**

Source: Utah Division of Oil, Gas and Mining.

Figure 1. Wells Drilled Per Year in the Price Field Office (1991-2003).



Source: Utah Division of Oil, Gas and Mining.

Total CBM production during 2002 reached 102,151,077 mcf, an increase of 10% over 2001 production (Figure 2 and Table 2). This increase is a function of new wells and the continuing dewatering process. Most of the individual wells in these fields exhibit a typical CBM production history characterized by high rates of water production initially followed by an increase in gas production accompanied by decreasing water production. The produced water is re-injected into deeper formations.

Figure 2. CBM Production Per Year in the Price Field Office (1987-2002).

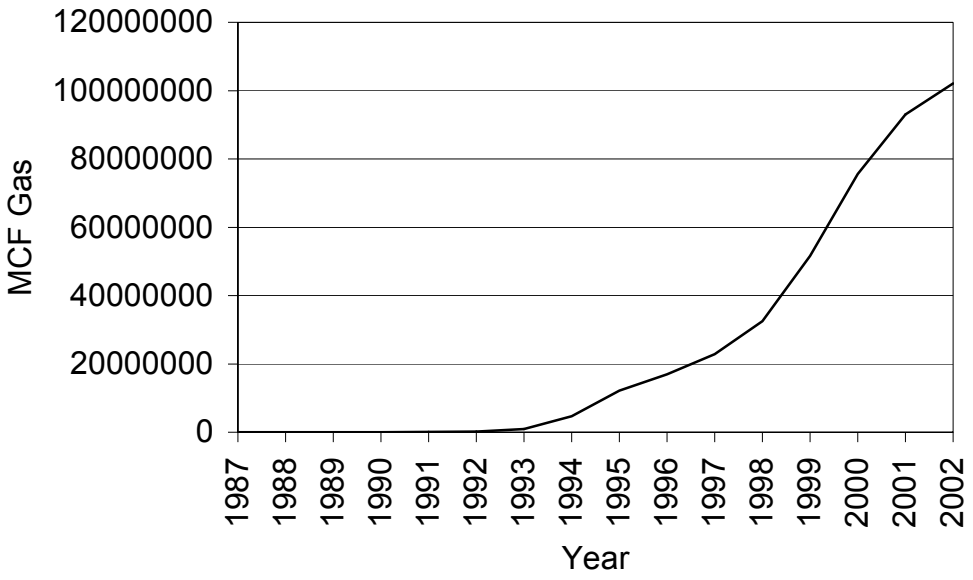


Table 2. CBM Production Per Year in the Price Field Office.

Year	CBM Production (MCF)
1987	8,884
1988	37,045
1989	0
1990	0
1991	76,098
1992	156,143
1993	904,731
1994	4,681,248
1995	12,206,608
1996	16,938,702
1997	22,883,343
1998	32,549,242
1999	51,658,926
2000	75,591,401
2001	93,043,290
2002	102,151,077

Renewed interest in the northeastern part of the planning area has resulted in an application for a 3-D seismic survey and APDs for several wells. Gas and small amounts of oil were produced from the Green River and Wasatch formations in the Peters Point and Stone Cabin Fields beginning in the 1950s. Interest is now focused on the continuous and transitional gas resources in the Wasatch and Mesaverde formations and

seismic surveys have identified drilling targets in deeper formations. Three Federal exploratory units have been designated in this area. The Price Field Office is currently conducting Environmental Analyses in the area resulting from proposals for a 3-D seismic survey and applications for permit to drill (APDs). Cumulative gas production from this area (Peter's Point, Prickly Pear and Stone Cabin Fields) is only 7,636,436 mcf (Utah Division of Oil, Gas and Mining).

In 2002, Carbon and Emery Counties ranked second and fifth respectively in gas production among Utah counties. Utah and the other Rocky Mountain gas producing states have become more integrated with the nation's natural gas system as a result of increased production and pipeline construction. The Kern River Pipeline crosses Utah diagonally from northeast to southwest and connects gas producing areas in Utah and southwestern Wyoming with consumers in southern Nevada and California. This pipeline was constructed in 1991 and significantly expanded in 2003 to a current capacity of 1.5 BCF per day (University of Utah Bureau of Economic and Business Research, 2003). Utah is now an overall exporter of natural gas and with the existing production and infrastructure, gas produced in the planning area should continue to reach an expanding market.

III. Oil and Gas Development Potential

Maps 27 and 28 in the Mineral Potential Report identify areas with a high potential for the occurrence of CBM and oil and gas respectively. Present activity is largely confined to development of the CBM resource in the Ferron Sandstone coals, often called the Ferron Fairway, and the continuous and transitional gas deposits in the Wasatch and Mesaverde formations in the northeastern part of the area (Tavaputs Plateau). Future development is expected to be concentrated in these same areas. The presence of the Sunnyside Special Tar Sand Areas in the Tavaputs Plateau region has negatively impacted oil and gas leasing here and legislation has been introduced to eliminate this classification or modify leasing procedures. If this, or similar, legislation is passed more exploration and development is possible in this area. Some exploration is likely to occur on the Wasatch Plateau testing the CBM resource contained in coalbeds in the Emery Sandstone Member of the Mancos Shale (Tabet and Quick, 2003). Significant exploration and development activity appears unlikely in other parts of the planning area.

Development drilling in the Ferron Fairway is on 160 acre spacing and there are no present indications that downspacing is likely. More innovative production drilling is likely involving horizontal holes from existing or new wells and inclined wells with multiple lateral legs ("herringbone pattern"). Overall, CBM drilling has declined during the past few years and it is unlikely that activity will return to the high levels of the period from 1999 to 2001. Utah Division of Oil, Gas and Mining statistics for 2003 show that 57 wells were drilled in Carbon and Emery Counties with the majority of these being CBM wells. The CBM fields appear to have reached a level of maturity where the significantly lower drilling rates will continue in the future discounting the possibility of major new drilling and recovery technologies or major sustained increases in natural gas prices. Available areas for expansion of activity in the Ferron Fairway are limited.

The Wasatch Plateau is in the Manti-La Sal National Forest where a significant number of oil and gas leases currently exist (Map 5 of the Mineral Potential Report). Some exploratory wells are likely in this area during the life of the plan. Coals in the Blackhawk Formation in the Wasatch Plateau appear to have little development potential (Mineral Potential Report, p. 80). As described above, coals in the Emery Sandstone Member of the Mancos Shale are a more likely exploration target in this area. A recent draft Mineral Potential Report covering the Fishlake National Forest (immediately southwest of the Manti-La Sal) projected few new wells for that Forest.

The northern part of the planning area includes the Book Cliffs CBM Play (USGS, 1995; Mineral Potential Report, 2002). The Castlegate Gas Field represents the only serious attempt to develop this resource to date. This field contained 19 active wells in October 2003 but has produced only 4,457,185 mcf of gas (Utah Division of Oil, Gas and Mining).

The remaining area with significant development potential is the Tavaputs Plateau area in the northeast corner of the planning area. Bill Barrett Corp. holds a block of leases in this area and is operator of three Federal exploratory units. Development is likely here when

EAs are completed for a 3-D seismic survey and several APDs. APDs have been filed for wells on both Federal and State of Utah lands. The target will be continuous and transitional gas deposit in the Wasatch and Mesaverde formations and possibly conventional gas occurrences in deeper formations. The Price Field Offices anticipates that a field development EIS will be undertaken if the initial group of proposed wells are successful. Existing wells and permit applications appear to be defining an 80 acre spacing for at least part of this area and the three units could accommodate approximately 550 wells. Topography will impact well location and a significant number of the wells would be directionally drilled which would reduce the surface impacts. The Vernal Field Office, immediately north of this area, includes a much larger portion of the Tavaputs Plateau region and projects 1,225 new wells during the next 15 years.

Notably absent from the above discussions is any mention of oil. During 2002 only 2,648 barrels of oil were produced in Carbon and Emery counties (Utah Division of Oil, Gas and Mining) and no significant oil production is expected in the future.

IV. Baseline Scenario Assumptions and Discussion

The baseline RFD is based on the continuation of current management and would apply to the no action alternative. Spacing of CBM wells is assumed to continue at 160 acres/well. An 80-acre spacing is projected for at least parts of the Tavaputs Plateau area. It is further assumed that natural gas prices will remain stable or increase gradually and that pipeline capacity will continue to be adequate to transport the produced gas. Table 3 shows projections for total new wells on BLM, USFS, State of Utah and Private lands over a 20-year time period.

Table 3. Number of Wells by Location Over 20-Years.

Well Location	**Number of Wells**
Emery/Book Cliffs Plays	700
Tavaputs Plateau	600
Remainder of Planning Area	240
Total	**1540**

It is anticipated that approximately 30 % of the new wells will be on State of Utah lands, 50 % on BLM lands, 10% in the Manti-La Sal National Forest and 10% on Private lands.

V. Disturbance Due to Oil and Gas Activity on All Lands

Projected Surface Disturbance

The following general guidelines for roads, drill pads, pipeline, and ancillary facilities were used to determine acres of surface disturbance associated with fluid minerals exploration and development activities. The assumptions are based on existing oil and gas development across the PFO.

Roads and Pipelines

- Average initial 70 feet total width disturbance for ¾ mile per well (6.4 acres).

- After reclamation, average disturbance of 20 feet total width disturbance for ¾ mile per well (1.8 acres).

Drill Pads

- Average initial disturbance of 1.5 acres including pits and cuts and fills per well.
- After reclamation, average disturbance of 1.0 acre per well.

Ancillary Facilities

- Average initial and long-term disturbance of 20 acres per facility (e.g. compressor stations and power lines).

Initial disturbance from roads, pipelines, and drill pads per well is estimated to be 7.9 acres and reclaiming to 2.8 acres per well for the life of the well. Table 4 and Table 5 show the initial and long-term surface disturbance by alternative directly associated with the number of oil and gas wells in Table 3.

Using the assumptions listed above (7.9 acres initially disturbed /well; reclaimed to 2.8 acres /well for the remainder of the well life) the following future initial and long term effects are calculated:

Initial Impacts: 12,366 acres

Long Term Impacts: 4,512 acres

Impacts from past and present activity are estimated at approximately 3,200 acres (after reclamation) and when added to projected future activity results in total disturbance of approximately 15,360 acres. Future initial impacts will be quickly reduced from 7.9 to 2.8 acres per well through reclamation of part of each drill pad resulting in a net total disturbance of approximately 8,000 acres.

Table 4. Initial Surface Disturbance from Oil and Gas Activity.

Type of Activity	Initial Surface Disturbance Per Year (Acres)	Initial Surface Disturbance Over 20 Years (Acres)
Roads and Pipelines	493	9,856
Drill pads	116	2,310
Ancillary Facilities	10	200
Total Surface Disturbance	**618**	**12,366**

Table 5. Long-Term Surface Disturbance from Oil and Gas Activity.

Type of Activity	Long-Term Surface Disturbance Per Year (Acres)	Long-Term Surface Disturbance Over 20 Years (Acres)
Roads and Pipelines	139	2,772
Drill pads	77	1,540
Ancillary Facilities	10	200
Total Surface Disturbance	**226**	**4,512**